

Beat the Flood

Teacher's Guide

This challenge is designed to help your pupils tackle a pressing global issue from a variety of perspectives. It's flexible, adaptable, and can be done in one day or in several sessions. At its heart you'll find rich learning activities which will engage your pupils in the challenge, and a flexible framework that can be adapted to suit your needs.

Context

Flooding due to **climate change** has the potential to cause devastation by destroying people's homes and lives. *Beat the Flood* enables pupils to learn about the effects of flooding, and the role of development organisations that support communities to develop homes that reduce their vulnerability to changing climates.

Set on the fictitious island of 'Watu', pupils are challenged to design a home for a community on Watu Island able to withstand the effects of flooding, then make a model of their design and test it.

We recommend dividing the class into small groups of 4-5 pupils to complete the challenge.

Make the most of the challenge for your pupils

Pupils completing the challenge can also be entered into:

- 💧 Practical Action's **Beat the Flood competition**. We are offering group and schools voucher prizes for an overall winning design from a primary and secondary school. Deadline: 30th April 2014. For more details go to www.practicalaction.org/beattheflood
- 💧 A **CREST Discovery Award** (suitable for secondary pupils), and CREST STAR Awards (primary).

The challenge overview (overleaf) indicates which activities are required for the competition and CREST Awards. For more detail look at *Beat the Flood* with CREST Star and CREST Awards sheet.



Setting the scene. Starter activities

Activity Name	Time	Documents needed	Beat the Flood challenge	Beat the Flood competition	CREST Discovery Award*
Starter questions	10 mins	One starter question sheet per pupil	Recommended	Required	Recommended
Starter activity: where in the world?	15 mins	One Where in the world? sheet and world map per group	Recommended	Recommended	Recommended
Who's at risk on Watu?	20 mins	One map of Watu Island and one set of community cards per group	Recommended	Recommended	Required

Main challenge activities

Activity Name	Time	Documents needed	Beat the Flood Challenge	Beat the Flood competition	CREST Discovery Award*
Learning from Others	30 mins	One Learning from others case study sheet per group	Recommended	Recommended	Required
Testing structures	30 mins	Teacher's notes and laminated structures template sheets 1 and 2 per group	Recommended	Recommended	Required
Testing materials for tensile strength and absorbency	30 mins	Teacher's notes and one pupil record sheet per group	Recommended	Recommended	Required
Costing activity sheet	20 mins	One costing sheet and one set of material cards sheets per group	Recommended	Recommended	Recommended
Developing a specification and designing a flood proof home	1 hr	One specification sheet and design ideas sheet per pupil. One final design sheet per group.	Required	Required	Required
Developing a model	1 hr		Required	Required	Required
<i>Beat the Flood</i> test	5 mins per group		Required	Required	Required
Pupils' presentations	5 mins per group	One How did they do? sheet per pupil	Recommended	Recommended	Required
Summative questions	10 mins	One summative question sheet per pupil	Recommended	Required	Recommended

*Details of suggested activities to gain the CREST Star Awards are available at practicalaction.org/beatthefloodcrest

Running the challenge

Ask the pupils to complete the starter question sheet. If you are entering our competition you will need to send these in with your entries.

Setting the Scene

The main PowerPoint presentation starts with five slides which set the global scene for the challenge, and introduces the Where in the world? activity.

You may also wish to show a video clip 'Beat the Flood: Flood resistant homes in Bangladesh' available at <http://www.youtube.com/watch?v=GICQpTosxS8>

Slides 6-8 introduce the challenge faced by the islanders on Watu. This begins the *Beat the Flood* challenge.

Give each group of pupils their community card and island map and allow them to read about their community. Ask pupils to identify the homes and others features within their community that they feel are most at risk, and have a class discussion about which are the main areas and risks of flooding for the islanders.

Pupils can mark on their maps the homes and areas most at risk of flooding. Encourage pupils to justify their choices and discuss them with classmates.

Main challenge

Slides 9-11 set the challenge to the pupils to 'Design a home for a community on Watu Island able to withstand the effects of flooding, and make a model of your design so you can test it.'

We suggest that all groups carry out independent research on flood-resistant homes to help the development of ideas. You may wish to use the *Beat the Flood* Learning from others sheet and the poster to introduce their research.

Depending on the time available and your subject area, you may wish to support pupils' learning with one or two of the activities below:

- Testing materials' absorbency and strength
- Testing different structures for strength
- Costing your home

Please note that if you wish to use this activity to gain a CREST Discovery Award, the materials and structures activities are mandatory.



Developing ideas and modelling

Hand out pupil design specification and design ideas sheets to all pupils and one final design sheet per group. Pupils can work either individually or as a group on the specifications and initial designs. Their final design should be decided as a group.

Allow pupils time to work through developing the specifications and their design ideas before working on the final group design.

When the pupils start to develop their ideas for the use of materials, you may wish to suggest that some modelling materials represent 'real-life' materials. For example, lolly sticks to represent wood, aluminium foil on card to represent corrugated metal. If you wish to do this, give each group a set of material information cards with ideas for modelling materials.

Modelling resources

bamboo	straws
cling film	plastic bottles
grass	string
leaves	glue
plasticine	split pins
lolly sticks	cardboard
mud	splints
tin foil	

Testing model homes

Please note that the aim of the challenge is for pupils to appreciate the design issues of flood-resistant housing. Making the model is a small part of the design process, and should be presented as such.

Allow pupils a set time to make their models before the *Beat the Flood* test. We suggest that each group takes a photograph of their model before and after the test.

Final testing equipment needed: washing up bowls or sink, water, hose pipe.

For the *Beat the Flood* test allow each group to test their model by standing them in 5cm of water in a washing up bowl or sink, then squirting with a hose for 2 minutes. You might also choose to add some debris to the water such as stones and sticks to make the test more realistic. You can use this as an opportunity to explore the reality of the test with students.



Pupils' presentations

Ask each group to prepare a presentation for the class. It should include:

- Their findings about the needs of their community and the homes most at risk of flooding on the island
- Why they chose the materials they have used
- Why they chose their structure
- Their final design
- How their model stood up to the flood test
- How well they worked as a team
- What they would do differently if they did it again

Give each pupil a How well did they do? sheet so that they can give each group marks for their design, model and team skills. You may wish to use the results to do a class tally to decide on an overall winner.

Certificates are available for everyone who takes part, with special certificates for the winners. They can be found on the *Beat the flood* main website page.

After the challenge

Allow pupils to complete the summative questions.

Scaling up: You can extend your pupils' experience by enabling them to develop a larger scale-model or section of their homes using real materials.

Beat the Flood competition

If you'd like to enter any of your pupils' designs into our competition, please send the following:

- Starter and summative question sheets
- Individual/Group design specification and initial design ideas sheets
- Group final design sheet
- Photograph of their model before and after the flood test

Please ensure that you include your own name and school details before sending them to: Beat the Flood Competition, Education Unit, Practical Action, Schumacher Centre, Bourton on Dunsmore, CV23 9QZ or email to schools@practicalaction.org.uk by 30th April 2014.



Materials and structures tests

Depending on the time available and your subject area, you may wish to select one or two of the activities below to help pupils learn about the different materials and structures suitable for homes in flood-prone areas.

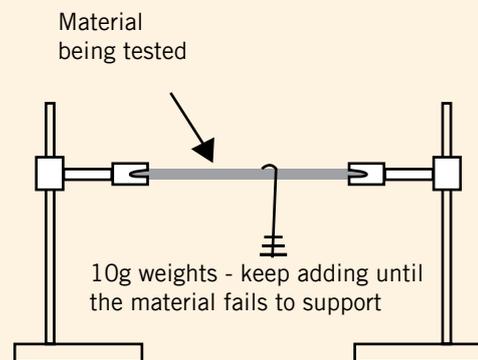
Materials tensile strength test

This test will enable pupils to record the tensile strength of materials, and decide if these materials are suitable for their designs and model homes.

Resources

Each group will need:

- 2 x stands and clamps
- Set of 10g weights
- Materials for testing
- Scissors
- 1 x material results table



Instructions

Ask pupils to:

- Set up the stands and clamps as shown above.
- Measure and cut materials to a standard size, 15cm x 2cm where possible, to ensure a fair test.
- Attach each material separately between 2 stands and clamps.
- Add 10g weights, one after another, until the material either bends or breaks.
- Record in their results table whether the material held the weight, buckled, or snapped under the weight.
- Record the maximum weight tolerated by each material.



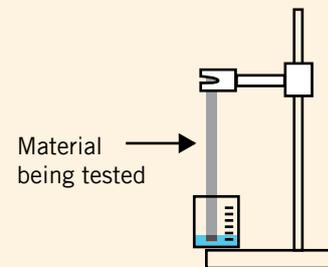
Materials absorbency test

This test will enable pupils to test the water absorbency of a range of materials.

Resources

Each group will need:

- Minimum 1 x stand and clamp (ideally 4 sets)
- Timer
- 6 x 100ml glass beakers
- Food colouring
- Ruler
- Materials for testing
- 1 x material results table



Instructions

Ask pupils to:

1. Set up stand and clamps as shown above. They can set up several at once or carry out the test one at a time.
2. Measure and cut materials to a standard size, where possible 15cm x 2cm, to ensure a fair test.
3. Attach each material to the stand and clamp so that it is held in a vertical position over a glass beaker containing 25ml of coloured water. (Use water dyed with food colouring to make it easier to see the progress of the coloured water soaked up by the material.)
4. Start the timer when the materials are lowered into the water.
5. Leave the materials suspended in the water for 3 minutes, then remove them from the water and measure the distance that the water has travelled.
6. Record materials absorbency on their results table.



Activity for testing structures

This activity enables pupils to learn about, evaluate, and model, shell and frame structures as to their suitability to develop homes for flood-prone areas.

Resources

Each group will need:

- 1 x structures template sheet 1 (laminated)
- 1 x structures template sheet 2 (laminated)
- Drinking straws
- Play-dough or blu tac
- Digital scales
- Cellotape
- Hairdryer
- Glue-gun
- Scissors
- Pupil activity sheet - Structures

Starter activity

- Ask pupils to arrange the images and facts as instructed in the Structures activity sheet.
- Discuss as a group their understanding of the structures and how they could translate to the building of a home.

Model and test activity

Ask each group to think about structures used in homes and ask them to develop:

- A pyramid and cube shell structure using the laminated sheets, one with 0g and one with 10g weight of play-dough inside.
- A range of frame structures using the straws, some without weight and some with 10g play-dough added.
- A structure that combines a frame structure with straws and laminated shapes.

When the models are built, allow pupils to test them in a tray of shallow water. Agitate the trays to create waves.

Findings should reveal

- The 0g shell structure will move easily.
- The 10g shell structure will have a little resistance to movement.
- The 10g frame structure will resist a good amount of movement.
- The 10g frame with shell at base will move easily.
- The 10g frame with shell part way up will resist a good amount of movement.

You may also wish to compare the structures and their resistance to wind.

With the models on a dry surface, using a hair dryer, the shell structures will have the greatest resistance to wind.

Emphasise the importance of understanding local conditions when designing.



Beat the Flood

Structures template 1

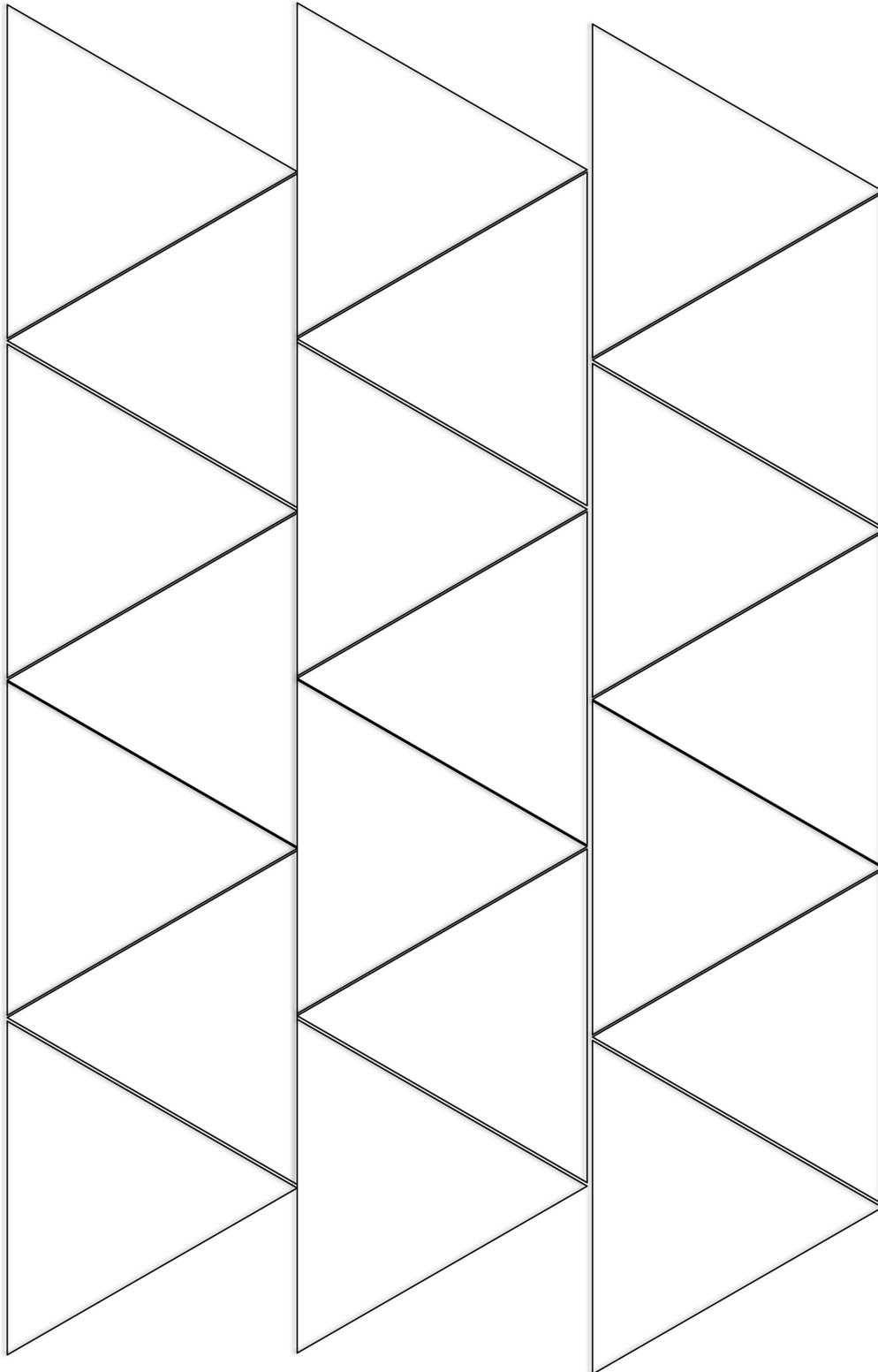
We suggest that the templates are printed onto card and laminated for pupils to use in the testing structures activity.



Beat the Flood

Structures template 2

We suggest that the templates are printed onto card and laminated for pupils to use in the testing structures activity.



Beat the Flood

Beat the Flood with CREST Star and CREST Awards

Practical Action has worked with the British Science Association to accredit the *Beat the Flood* challenge as part of the CREST Star Awards and CREST Awards. CREST Star Awards are aimed at children, usually aged 5-11, to develop their science, technology, engineering and mathematical problem solving skills. CREST Awards are primarily aimed at children aged 11-19.

CREST Star Awards

There are three levels of award:

Star is primarily aged at 5-7 year olds, and requires children to complete eight short investigations from a pool of fantastic, simple to run activities.

Superstar is the next step up, but you don't need to complete Star to start Superstar. Children complete 12 investigations, at a slightly higher level of complexity. Superstar is designed to bridge the 5-11 year old age range, but will typically work best for children aged 7-9 years.

Megastar is the final step on the CREST Star ladder. Children complete three longer guided investigations, and receive their Megastar Award.

To start delivering CREST Star Awards in your school or organisation, you need to join the scheme. There's a £20 joining fee, plus an annual fee of £20. (So you pay £40 in your first year, and £20 in subsequent years.) Once you join, you get access to the online resources which include amazing activities, and the ability to print your own logbooks, stickers and certificates for your students.

To use the *Beat the Flood* challenge to gain CREST Star Awards, you must first be a member of the scheme. Then you can:

- Use one of the Materials and Structures tests as **one** activity towards a **Superstar Award**. Children must **fully complete** the activity and be able to explain the outcomes to their teacher or another adult. To receive the award, students need to complete a further **eleven** investigations from the pack.
- Use the **main challenge**, as long as you complete the Materials and Structures tests to a KS2 standard, as **one** investigation towards a **Megastar Award**. To get the award, students need to complete a further **two** investigations from the pack.

Though their standard of performance is not assessed, we expect teachers to have high expectations of their pupils, and only count the activity if children have worked hard and remained on task. This ensures that students show an understanding of what they have done.

CREST Discovery Award

Not in a primary school? Got high ability students? Here's the answer: the *Beat the Flood* Challenge is accredited as a **CREST Discovery Award** project. CREST Discovery is a brand new award for September 2013.



Beat the Flood

It rewards students; mainly in key stage three; who complete a day-long STEM Challenge that develops skills they would need to work in STEM, which are:

- 💧 **Self management** – learning to accept responsibility for tasks and (where appropriate) show leadership of a group
- 💧 **Team working** – learning to cooperate effectively with others, make a positive contribution to a team while respecting others' contributions, and developing interpersonal skills
- 💧 **Problem solving** – learning to analyse and solve technical problems and to apply creative (imaginative) approaches in developing realistic, innovative and original solutions
- 💧 **Research** – learning to acquire new knowledge and apply it appropriately
- 💧 **Communication** – learning to assimilate and pass on information effectively
- 💧 **Reflective practice** – learning to recognise the impact their actions have on a project, and how they can improve that impact (either by minimising negative impact or maximising positive benefit).

To complete the *Beat the Flood* challenge as a CREST Discovery Award project, you will need to contact your CREST Local Coordinator. They will explain the requirements in detail, provide the materials for students to record their thoughts about their work, register the students and accept the registration fee of £3 per student.

CREST Discovery Awards are assessed by teachers in school. Alternatively your CREST Coordinator may invite STEM Ambassadors to assess if you both agree this is the best way to complete the assessment. The Award is not automatic, and your CREST Coordinator will be able to explain assessment when you discuss this with them.

We will expect all students completing the Challenge as a CREST Discovery Award to complete the activities indicated as required for CREST Discovery in the Challenge Overview. This does not mean you cannot complete the other activities, but the required ones are the minimum we expect. Each student will also be required to complete a CREST Discovery passport, which you can obtain from your CREST Coordinator.

Enjoyed your CREST Discovery Awards? Great! Why not move to the next level and do some Bronze, Silver and Gold projects. Talk to your local coordinator to find out more – you can use **Practical Action's Global CREST Challenges** as a starting point. Go to www.practicalaction.org/crest to find out more.

You may well be asking yourself how an activity can be accredited at so many different levels of award. Simply put, CREST looks for students demonstrating skills and knowledge appropriate to stages of education. So, for a Superstar or Megastar Award, we look for students demonstrating KS2 skills and knowledge, regardless of the age of the student. For a Discovery Award, we look for students demonstrating KS3 skills and knowledge levels. This differentiated expectation means we can include the *Beat the Flood* challenge in several levels of Award.

For more information about CREST or CREST Star, please contact your local CREST Coordinator. You can find their details here:

www.britishecienceassociation.org/crest-awards/finding-your-crest-local-coordinator-list-view



Beat the flood

Congratulations!

on being a member of the **WINNING** team in
Practical Action's Beat the Flood Challenge

Name Class

Signed Date

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PRACTICAL ACTION
Technology challenging poverty



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